

WHAT IS CLAIMED IS:

1. An isolated nucleic acid encoding an MEKK interacting FHA protein (MIF1), wherein the nucleic acid has a property selected from the following:
  - a) it can be amplified by polymerase chain reaction (PCR) using an oligonucleotide primer derived from SEQ ID NO:1 or SEQ ID NO:7;
  - b) it hybridizes under stringent conditions with a nucleic acid having a nucleotide sequence as depicted in SEQ ID NO:1;
  - c) it encodes a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:2, SEQ ID NO:8, splice variants thereof, and allelic variants thereof;
  - d) it encodes a polypeptide which specifically binds to an antibody generated against a peptide corresponding to amino acids 16-28 of MIF1 as depicted in SEQ ID NO:8.
2. The isolated nucleic acid of claim 1 wherein the MIF1 has an amino acid sequence as depicted in SEQ ID NO:2.
3. The isolated nucleic acid of claim 2 comprising a nucleotide sequence as depicted in SEQ ID NO:1.
4. The isolated nucleic acid of claim 1 wherein the MIF1 has an amino acid sequence as depicted in SEQ ID NO:8.
5. The isolated nucleic acid of claim 4 comprising a nucleotide sequence as depicted in SEQ ID NO:7.
6. The isolated nucleic acid of claim 1 wherein the oligonucleotide primer is selected from the group consisting of SEQ ID NOS: 10, 11, and 4.
7. The isolated nucleic acid of claim 1, further comprising a sequence encoding a polypeptide tag, whereby the nucleic acid encodes a chimeric tagged MIF1 protein.
8. A vector comprising the nucleic acid of claim 1.
9. The vector according to claim 8 wherein the sequence coding for MIF1 is operatively associated with an expression control sequence permitting expression of MIF1 polypeptide in an expression competent host cell.

10. The vector according to claim 9 selected from the group consisting of an RNA molecule, a plasmid DNA molecule, and a viral vector.
11. The vector according to claim 10 which is a plasmid DNA molecule, further comprising a composition selected from the group consisting of a DNA condensing protein, a cationic lipid, a liposome, a polymer, and a DNA precipitating agent.
12. The vector according to claim 10 which is a viral vector selected from the group consisting of retrovirus, adenovirus, adeno-associated virus, herpes virus, and vaccinia virus.
13. A host cell transfected with the vector of claim 8.
14. A host cell transfected with the vector of claim 9.
15. The host cell of claim 14 selected from the group consisting of a bacterial cell, a yeast cell, and a mammalian cell.
16. A method for producing MIF1 comprising:
  - a) culturing the host cell of claim 14 in culture medium under conditions permitting expression of MIF1; and
  - b) isolating the MIF1 from the culture.
17. An oligonucleotide of at least 10 bases which hybridizes under stringent conditions to a nucleotide having the sequence or the complementary sequence depicted in SEQ ID NO:7.
18. The oligonucleotide of claim 17 which is a 1069 bp KpnI-BamHI fragment obtained from pCM562 plasmid (encoding full length MIF1).
19. The oligonucleotide of claim 17 which has an nucleotide sequence selected from the group consisting of SEQ ID NO:10, SEQ ID NO:11, and SEQ ID NO:4.
20. An isolated MEKK interacting FHA protein (MIF1), wherein the MIF1 has a property selected from the following:
  - a) it is encoded by the nucleic acid of claim 1;
  - b) it has an amino acid sequence selected from the group consisting of SEQ ID NO:2, SEQ ID NO:8, splice variants thereof, and allelic variants thereof; and

c) it specifically binds to an antibody generated against a peptide corresponding to amino acids 16-28 of MIF1 as depicted in SEQ ID NO:8.

21. The isolated protein of claim 20 which is murine.

22. The isolated protein of claim 20 which is human.

5 23. The isolated protein of claim 20 comprising an amino acid sequence as depicted in SEQ ID NO:2.

24. The isolated protein of claim 20 comprising an amino acid sequence as depicted in SEQ ID NO:8.

10 25. The isolated protein of claim 20 which comprises a polypeptide tag, whereby the protein is a chimeric tagged MIF1 protein.

26. An antigenic peptide which is a fragment of an isolated MEKK interacting FHA protein (MIF1), wherein the MIF1 has a property selected from the following:

a) it is encoded by the nucleic acid of claim 1;

15 b) it has an amino acid sequence selected from the group consisting of SEQ ID NO:2, SEQ ID NO:8, splice variants thereof, and allelic variants thereof; and

c) it specifically binds to an antibody generated against a peptide corresponding to amino acids 16-28 of MIF1 as depicted in SEQ ID NO:8.

27. The antigenic peptide of claim 26 which has an amino acid sequence corresponding to amino acids 16-28 of SEQ ID NO:8.

20 28. An antibody which specifically binds an MIF1 protein of claim 20.

29. The antibody of claim 28 which specifically recognizes MIF1 amino acids 16-28 of SEQ ID NO:8.

30. The antibody of claim 28 which is polyclonal.

31. A method for detecting expression of mRNA encoding MIF1 in a cell comprising

25 a) contacting a sample from the cell with an oligonucleotide of claim 17 which is detectable and

b) detecting hybridization of the oligonucleotide with an mRNA in the sample, wherein detection of hybridization of the oligonucleotide with mRNA indicates expression of mRNA encoding MIF1.

32. A method for detecting expression of MIF1 protein in a cell comprising

5 a) contacting a sample from the cell with an antibody of claim 28 under conditions permitting binding of the antibody to an MIF1 protein in the sample, and

b) detecting binding of the antibody to a protein in the sample, wherein detection of binding of the antibody to the protein indicates expression of MIF1 in the cell.

33. A method of screening for molecules that modulate the activity of MIF1 comprising

10 a) contacting an MIF1 protein with a candidate molecule, wherein the MIF1 protein is selected from the group consisting of a protein having the amino acid sequence depicted in SEQ ID NO:8, an allelic variant of the protein having the amino acid sequence depicted in SEQ ID NO:8, a splice variant of the protein having the amino acid sequence depicted in SEQ ID NO:8, and a homologous protein from another species of the protein having the amino acid sequence depicted in SEQ ID NO:8; and

15 b) detecting binding of the molecule to the MIF1 protein.

34. The method according to claim 33, wherein detection of the binding of the molecule to MIF1 comprises detecting modulation of the interaction of MIF1 and MEKK.

20 35. The method according to claim 34, wherein modulation of the interaction of MIF1 and MEKK comprises detecting a change in the level of expression of a reporter gene expressed under control of a chimeric protein consisting of the MIF1 binding domain of MEKK and a DNA binding domain of a transcription activator in a cell line transfected with MIF1 and the MEKK chimeric protein.

25 36. The method according to claim 35, wherein detection of expression is in transiently transfected mammalian cell.

37. The method according to claim 33 wherein the molecule is an agonist of MIF1.

38. The method according to claim 33 wherein the molecule is an antagonist of MIF1.

39. A method of decreasing MEKK activity in a cell comprising increasing the level of MIF1

protein in the cell, wherein the MIF1 protein is selected from the group consisting of a protein having the amino acid sequence depicted in SEQ ID NO:8, an allelic variant of the protein having the amino acid sequence depicted in SEQ ID NO:8, a splice variant of the protein having the amino acid sequence depicted in SEQ ID NO:8, and a homologous protein from another species of the protein having the amino acid sequence depicted in SEQ ID NO:8.

40. The method according to claim 39 wherein the homologous protein from another species is a murine MIF1 protein.

41. The method according to claim 39 wherein the cell has been transfected with a vector encoding MIF1 under conditions permitting expression of the MIF1 protein.

42. A method of increasing MEKK activity in a cell, comprising decreasing the level of MIF1 protein in the cell, wherein the MIF1 protein is selected from the group consisting of a protein having the amino acid sequence depicted in SEQ ID NO:8, an allelic variant of the protein having the amino acid sequence depicted in SEQ ID NO:8, a splice variant of the protein having the amino acid sequence depicted in SEQ ID NO:8, and a homologous protein from another species of the protein having the amino acid sequence depicted in SEQ ID NO:8.

43. The method according to claim 42 wherein the level of MIF1 protein is decreased by introducing an MIF1 antisense nucleic acid into the cell, which antisense nucleic acid hybridizes under intracellular conditions to an MIF1 mRNA.

44. The method according to claim 42 wherein the level of MIF1 protein is decreased by introducing an a single chain Fv antibody (scFv) that specifically binds MIF1 into the cell at a level sufficient to bind to and inactivate MIF1